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that of arch or branch repair, the period of CPB is not prolonged even though distal anastomoses of CABG are performed during CPB. Aortic crossclamping (myocardial ischemia) in our strategy is required only during arch repair and is far shorter than that in Yokoyama and colleagues' procedure (during both proximal anastomoses of CABG and arch repair). Even though distal anastomoses of CABG are undertaken during aortic crossclamping (*dotted column* in Figure 1) in our strategy when the anastomoses are technically complicated and cannot be performed under on-pump beating heart surgery, the period of aortic crossclamping is as long as that in Yokoyama and colleagues' procedure.

Yokoyama and colleagues' combined procedure of OPCAB grafting and aortic arch repair prolongs total operation time, because the extra period of distal anastomoses of OPCAB grafting is indispensable in addition to the period of CPB. Distal coronary artery anastomoses under on-pump beating heart surgery with sufficient decompression of the heart and without hemodynamic deterioration must be technically easier than that under off-pump beating heart surgery. Moreover, the period of aortic crossclamping (myocardial ischemic time), including proximal anastomoses of CABG, in Yokoyama and colleagues' procedure is longer than that in our strategy. Which strategy do you prefer?

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Reply to the Editor:

We thank Dr Takagi and associates for raising important questions on our recent proposal of the introduction of off-pump coronary artery bypass (OPCAB) into the combined operation of coronary revascularization and aortic arch repair (AAR) using antegrade selective cerebral perfusion.[1]

The first question is, "Does the introduction of off-pump coronary artery bypass into aortic arch aneurysm repair minimize the period of myocardial ischemia and cardiopulmonary bypass?" The answer is, "Yes." Recently, we reviewed our experience on the patients who underwent the simultaneous operation of total arch replacement (TAR) for atherosclerotic aortic aneurysm and coronary artery bypass grafting (CABG) between 1992 and 2004 (unpublished data). In the conventional coronary artery bypass (CCAB) group, distal coronary artery anastomosis (CABG distal) was constructed using the CCAB technique. Since 1998, CABG distal has been constructed on the beating heart before the cardiopulmonary bypass (CPB) period (OPCAB group). The demographics were similar in both groups; however, the surgical outcomes were dissimilar (Table 1). These preliminary data showed a decreased period of myocardial ischemia and CPB with fewer postoperative adverse effects in the OPCAB group.

Dr Takagi and associates also described another conventional technique in their letter, in which distal CABG is constructed on the beating or fibrillating heart under CPB during the cooling period and proximal CABG is constructed after AAR using a lateral aortic clamp. Then, the second question is raised: "Which procedure is preferred?" The answer is, "Either, as long as the outcome is excellent." The choice of procedure depends on the specific patient's pathology and status, as well as the specific surgeon's strategy and skill. The operation should be fitted for the patient.

In this simultaneous operation, there are several options; CABG distal can be constructed on the beating, arrested, or fibrillating heart; CABG proximal can be constructed before or after AAR, with aortic crossclamping or lateral clamping. As long as the entire procedure is performed, either way, with appropriate myocardial protection and coronary revascularization within a tolerable CPB period, the outcome is expected to be satisfactory. Recently, a CPB period longer than 300 minutes in AAR was demonstrated as an independent

TABLE 1. Demographics, intraoperative data, and early outcome of the patients who underwent coronary revascularization and total arch replacement for atherosclerotic aortic arch aneurysm

	Solo TAR (n = 18)		OPCAB (n = 18)		CCAB (n = 14)
Demography					
Age (y)	72 (58-79)		70 (62-80)		71 (64-79)
Gender (M/F)	15/3		17/1		11/3
Diseased coronary artery	0	*	1.5 (1-3)		1.5 (1-3)
Hypertension	17 (94%)		18 (100%)		13 (93%)
Left ventricular hypertrophy	7 (39%)		11 (62%)		10 (71%)
Old cerebral infarction	12 (67%)	*	5 (28%)		3 (21%)
Intraoperative data					
CPB time (min)	206 ± 33	*	239 ± 35	*	306 ± 61
>300 min	0		1 (6%)	*	7 (50%)
Myocardial ischemic time (min)	125 ± 30		133 ± 24	*	180 ± 48
>180 min	1 (6%)		0	*	5 (36%)
Early outcome					
Perioperative myocardial infarction	1 (6%)		0		2 (14%)
Stroke	1 (6%)		0		2 (14%)
Prolonged (>48 h) intubation	6 (33%)		6 (33%)	*	11 (79%)
In-hospital death	1 (6%)		1 (6%)		3 (21%)

TAR, Total arch replacement; *OPCAB,* off-pump coronary artery bypass; *CCAB,* conventional coronary artery bypass; *CPB,* cardiopulmonary bypass. Solo TAR group: The patients underwent TAR without coronary revascularization. OPCAB group: Distal coronary artery anastomosis was constructed on the beating heart before cardiopulmonary bypass (CPB). CCAB group: Distal coronary artery anastomosis was constructed on CPB. Data are expressed as mean ± standard deviation. Parentheses represent the value range, unless otherwise stated. $*P < .01$ difference between the 2 groups, analyzed by Mann-Whitney *U* test or chi-square test.

risk factor for in-hospital mortality by a multivariate analysis.[2] Reduction of the period for each procedure, as seen in the shorter "CABG proximal" bar in Dr Takagi and associates' strategy, seems to reduce the CPB period. We are, however, afraid that the "CABG distal" bar during the CPB period in their strategy would become much longer, depending on the number of diseased coronary arteries. Recently, cardiac surgeons are seeing more and more elderly patients with aortic aneurysm and multivessel coronary artery disease in civilized countries like Japan where the senior population is growing rapidly. We recommend our strategy especially for elderly patients with comorbidities who can poorly tolerate an elongated CPB time and still require multiple coronary revascularization.

For surgeons who are not fully familiar with the OPCAB technique, here is a tip: The patient is heparinized and cannulated for CPB; OPCAB on the anterior cardiac wall (the left anterior descending and diagonal artery) is performed first; the surgeon, faced with some difficulties in OPCAB on the other wall, initiates CPB to decompress the beating heart and maintain the hemodynamics. The patient has already avoided an unnecessary CPB period.

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doi:10.1016/j.jtcvs.2005.05.040

Pressure gradient in hemodynamics: Is it measured in units of pressure?

To the Editor:

I read with interest the article on pulmonary banding by Piluiko and colleagues[1] and the relevant discussion. Piluiko and colleagues[1] repeatedly expressed values of the "pressure gradient" across the banded pulmonary artery in units of pressure (milliliters of mercury). They thus committed an inaccuracy common in biomedical scripts. The correct formula for expressing a hemodynamic gradient should be pressure divided by distance (millimeters of mercury per millimeter). Alternatively, the term *pressure gradient* should be replaced with *pressure difference,* the latter being appropriate in this case because the accurate computation of the former may not be easy by conventional angiography.

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doi:10.1016/j.jtcvs.2005.04.027

Reply to the Editor:

I thank Dr Protopapas for the reminder that the strict definition of *gradient* is the rate of change of temperature, pressure, or another variable as a function of distance. In cardiovascular medicine we do, however, commonly use the term *pressure gradient* to describe the difference in pressure between two communicating cardiovascular chambers. Although this latter definition does not conform to the definition of gradient contained in physics textbooks, it is listed without apology in *Stedman's Medical Dictionary,* just a few lines below the formal physics definition of this term.[1] Perhaps primordial physicians selected the term *gradient* to describe drops in pressure across various types of vascular obstructions because it appeared more descriptive and dramatic than the word *difference.* Difference falls rather dull and flat upon the human ear. Whatever the reason, *pressure gradient,* as used in our article,[2] is a commonly used medical term that I predict will persist because its particular meaning in cardiovascular medicine is widely accepted and understood. I suggest we acknowledge that by virtue of common usage some terms are used in different contexts to mean different things. Our use of the term *pressure gradient* in the context of a discussion on pulmonary artery bands was clear and unambiguous.

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Uses of the leukocyte-depleting filter

To the Editor:

I was interested to read Ilmakunnas and colleagues' recent article,[1] in which they showed that the Pall LG6 leukocyte-depleting filter (Pall Biomedical, Portsmouth, United Kingdom) quite clearly does not reduce the activation of neutrophils and monocytes in clinical practice. As they explained, the previous literature on this subject has been quite unclear, with some finding a reduction in inflammatory markers and others finding a marked increase in elastase.[2,3] My colleagues and I[4] recently found that the LG6 filter significantly reduces cerebral microemboli detected by transcranial Doppler but also raises serum elastase. The mechanism by which the LG6 filter reduces microemboli is unknown but unlikely to be inflammatory mediated, according to Ilmakunnas and colleagues' results,[1] and is therefore more likely to be a simple physical effect. Although the reduction in microemboli was not accompanied by a significant improvement in neuropsychologic outcome,[4] the LG6 filter still has the potential for benefit by reducing microemboli.

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